IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant:	Kai Sorge
Serial No.:	10/561,422
Filed:	12/19/2005
Group Art Unit:	3746
Examiner:	Comley, Alexander Bryant
Title:	METHOD FOR CONTROLLING OPERATION OF A COMPRESSOR

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Commissioner for Patents
P.O. Box 1450
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APPEAL BRIEF

Dear Sir:

Appellant submits this Appeal Brief pursuant to the Notice of Appeal filed August 2, 2011. The Commissioner is authorized to charge Deposit Account No. 50-1482 in the name of Carlson, Gaskey & Olds, $540.00 for the appeal brief fee. Any additional fees or credits may be charged or applied to Deposit Account No. 50-1482 in the name of Carlson, Gaskey & Olds.

REAL PARTY IN INTEREST

The real party in interest is Continental Automotive Systems US, Inc., assignee of the present invention.

RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, interferences or judicial proceedings related to this appeal, or which may directly affect or may be directly affected by, or have a bearing on, the Board's decision in this appeal.

STATUS OF CLAIMS

Claims 13, 15 and 17-24 are pending, stand rejected and are appealed.

STATUS OF AMENDMENTS

All amendments have been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

The present invention relates to a method for controlling the operation of a compressor, in which the compressor is switched off by a control unit to avoid thermal damage if an estimated temperature value of the compressor Ts(Tc) exceeds an upper threshold value T_{max}, or remains switched on or is switched on if there is a compression requirement and if a lower threshold value T_{min} is not reached. The estimated temperature value Ts(Tc) of the compressor is determined indirectly and cyclically by means of a mathematical-physical model characterizing the cooling and heating properties of the compressor.

A relative temperature module 2 calculates and stores characteristic relative temperature of the compressor Tc that describes the thermal state of the compressor. At short time intervals, this relative temperature Tc, preferably two relative temperatures Tc_1; Tc_2, is/are newly calculated cyclically, for example under the control of a clock generator. (Page 7, lines 10-15, paragraph 24)

To calculate the relative temperature Tc, a compressor cooling value representing an amount by which the compressor has cooled since the last calculation cycle on account of the peculiarities of the compressor and its installation surroundings is calculated in a cooling software module 4, by means of the cooling function A(Tc) . The relative temperature Tc at the last time interval is made available by the holding element 3. The cooling value is then subsequently subtracted from the previous relative temperature Tc (minus sign), so that a new value for the relative tempterature Tc is formed. (Page 7, lines 16-30, paragraph 25)

During compressor operation, waste heat is represented as a heating-specific influencing variables 7 as relevant measured values and converted in a so-called heating module (main

memory 5 in the control unit) with the aid of a heating function B(U) stored there into a heating value, which in the sense of a physical model takes into account all those influencing factors which act on the compressor in a temperature-increasing manner. The value of the heating function B(U) newly calculated cyclically in this way is added to the currently applicable relative temperature Tc (switch 6 with plus sign) in particular, but not exclusively, when the compressor is switched on, so that a new relative temperature Tc, which takes into account both all the cooling influencing factors and all the, possibly to be considered, heating influencing factors, is obtained. Then this current value for the relative temperature Tc is used to determine in an estimated temperature module 1 the cyclically currently applicable estimated temperature Ts(Tc) of the compressor, which is used for the further operating control (switching on or off, depending on the compression requirement and the operating temperature) of the compressor. (Page 8, lines 1-18, paragraphs 26-28)

If the estimated temperature of the compressor exceeds the allowable upper temperature limit, the compressor must be switched off. However, it is switched on if there is a compression requirement and the estimated temperature falls below a lower temperature limit value, or if it can be expected that the cooling is adequate to allow a required actuating task (for example changing the level of the vehicle) to be completely carried out without overheating. (Page 8, lines 19-26, paragraph 29)

Claim 13

Claim 13 recites a method for controlling the operation of a compressor, in which the compressor is switched off by a control unit to avoid thermal damage if a compressor temperature value (Ts(Tc)) calculated by the unit exceeds an upper threshold value (T_{max}), or remains switched on or is switched on if there is a compression requirement and if a lower threshold value (T_{min}) is not reached. The method requires the steps of storing a mathematical-physical model in memory of the control unit wherein the mathematical-physical model characterizes cooling and heating properties of the compressor, and calculating a temperature value (Ts(Tc)) of the compressor indirectly and cyclically by means of the mathematical-

physical model by determining physical-technical influencing variables (U), which influence the estimated temperature (Ts(Tc)) in a changing manner. The method further requires determining, with the aid of the influencing variables (U), at least one relative temperature (Tc_1; Tc_2), which describes the thermal state of the compressor and adding or subtracting, for this purpose, the currently applicable influencing variables (U) from the cyclically prior value of the relative temperature (Tc_1, Tc_2), so that a currently applicable relative temperature (Tc_1; Tc_2) is obtained as the result of this calculation. Further, the method requires the step of determining a currently applicable estimated temperature (Ts(Tc)), taking into account the heating and cooling behavior of the compressor, from this currently applicable relative temperature (Tc_1; Tc_2) and the ambient temperature ($T\infty$) of the compressor, and then using this cyclically calculated temperature (Ts(Tc)) for carrying out a limit value comparison with a lower temperature threshold value (T_{min}) and an upper temperature threshold value (T_{max}), on the basis of which the operation of the compressor is controlled. The influencing variables (U) are entered in a heating function (B(U)), which describes the heating behavior of a specific compressor. (Page 8, line 28 - page 11, line 2, paragraphs 30-36)

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

(1) Is the rejection of Claims 13, 17-18, 20 and 24 under 35 U.S.C. § 102(b) as being anticipated over U.S. Patent No. 6,212,451 to Kutscher et al. ("Kutscher") improper?

(2) Is the rejection of Claims 15, 19 and 21 under 35 U.S.C. § 103(a) as being obvious over Kutscher in view of U.S. Patent No. 6,799,950 to Meier et al. ("Meier") improper?

(3) Is the rejection of Claims 22-23 under 35 U.S.C. § 103(a) as being obvious over Kutscher in view of Meier as applied to claims 15, 19 and 21 above, and further in view of U.S. Patent no. 6,758,051 to Jayanth et al. ("Jayanth") improper?

ARGUMENT

(1) Claims 13, 17-18, 20 and 24 are not anticipated over Kutscher.

Claim 13 recites method steps for controlling the operation of a compressor based on a compressor temperature value (Ts (Tc)). The compressor temperature is determined utilizing a mathematical-physical model that characterizes cooling and heating properties of the compressor. The Examiner argues that the Kutscher reference also discloses these features. Appellant disagrees. The Kutscher reference discloses a device and method of determining conditions of the environment within which a compressor is mounted, NOT the actual temperature of the compressor (Please see Kutscher, column 3, lines 40-45.)

An anticipation rejection requires that a single reference disclose each and every claimed feature. In this instance, the Kutscher reference cannot disclose the determination of a compressor temperature. Everything in the Kutscher reference is directed to the determination of conditions in a specific environment or space, not the actual temperature or condition of the compressor. The determined conditions of the environment are then utilized in the Kutscher system to for example, the Kutscher disclosure states:

> *An essential advantage of the pneumatic suspension leveling system in accordance with the invention is to be seen in the fact that the on-time duration (relative and absolute) of the compressor 1 is matched to the operating conditions prevailing in the compressor environment, that is--as shown--preferably the air temperature and air flow speed in the compressor vicinity.*

Column 4, lines 56-63 of Kutscher.

Accordingly, the entire purpose, and disclosure provided by Kutscher is to provide a method and device of determining the environmental conditions surrounding the compressor to provide a measure of possible heat transfer within the compressor environment. It is this measure and prediction of the compressor environment (not the compressor) that is disclosed by Kutscher. Moreover, it is the prediction of the environment surrounding the compressor that is then utilized to control operation of the compressor.

Claim 13 requires specific method steps for calculating a temperature value of the compressor based on operation and characteristics of the compressor. Claim 13 requires the step of calculating a temperature value (Ts (Tc)) of the compressor indirectly and cyclically by means of the mathematical-physical model. The Kutscher reference does not disclose nor is it directed toward a determination of the compressor temperature and therefore Kutscher cannot anticipate the features of claim 13.

Further, claim 13 requires the step of determining a currently applicable estimated temperature (Ts(Tc)), taking into account the heating and cooling behavior of the compressor, from this currently applicable relative temperature (Tc_1; Tc_2) and the ambient temperature ($T\infty$) of the compressor. Again, the Kutscher reference describes and discloses a system that determines a temperature of an environment within which a compressor is located, not the temperature of the compressor. Accordingly, Kutscher cannot anticipate the determination of an estimated compressor temperature as is required by claim 13.

Accordingly, for at least these reasons the Kutscher reference cannot anticipate claim 13 and therefore the rejections based on Kutscher should be reversed.

Dependent Claims

Dependent claims 17-18, 20 and 24 depend are allowable because they depend from an allowable independent claim. Moreover, the dependent claims include further features that are not disclosed nor suggested by the Kutscher.

Claim 17 requires that the influencing variable (A (Tc)) represents a cooling function which takes into account the cooling properties of a specific compressor along with the surroundings of the compressor. The Kutscher reference does not disclose the determination of a compressor temperature and therefore does not utilize a function that represents a cooling function of the compressor. The Examiner argues in general that this is a step that would naturally occur in the Kutscher process. As appreciated, an anticipation rejection requires that the reference disclose the claimed feature. Kutscher fails to disclose the claimed feature. The argument that such a feature would "naturally occur" is not a proper basis for an anticipation

rejection. Accordingly, Kutscher does not disclose this feature and the rejection of claim 17 should be reversed.

Claim 18 requires that to calculate a current value of the relative temperatures ($Tc_{1,i}$; $Tc_{2,i}$), the value of the cooling function (A(Tc)) is subtracted from the last predetermined or calculated values of the relative temperatures ($Tc_{1,i-1}$; $Tc_{2,i-1}$) if the compressor is not in operation or is in operation in the time interval considered, and the value of a heating function B(U) is added if the compressor is in operation in the time interval considered. Again, because the Kutscher reference does not disclose a determination of a compressor temperature, it cannot anticipate the steps required by claim 18.

Claim 20 requires that the initial value of the relative temperature (Tc) is chosen such that the calculated temperature (Ts (Tc)) of the compressor corresponds to the value of the ambient temperature ($T\infty$) at the installation location of the compressor. The Kutscher reference does not disclose a method of determining a compressor temperature and therefore cannot anticipate any feature relating to the determination of a compressor temperature. In this regard, the setting of calculated temperature of the compressor is not disclosed by Kutscher. Kutscher discloses a method of determining the conditions in an environment surrounding a compressor, not conditions of the compressor itself (Please see Kutscher Column 4, lines 59-62). Accordingly, Kutscher cannot anticipate the requirement so claim 20.

Claim 24 requires that even if the calculated temperature (Ts (Tc)) is greater than the temperature threshold value (T_{min}), the compressor may be switched on if the operating time of the compressor, until the upper threshold value (T_{max}) is reached, is sufficient to convey an amount of pressure medium adequate for a specific application. Kutscher simply makes no mention, nor disclosure of operating a compressor based on the limitations set out in claim 24. The examiner refers only to the general operation of Kutscher in rejecting claim 24, but cannot cite to any disclosure or part of Kutscher that discloses the features required by claim 24. Accordingly, there is nothing in Kutscher that anticipates the requirements of claim 24 and therefore, this rejection should be reversed.

(2) Claims 15, 19 and 21 are not obvious over Kutscher in view of Meier.

Claims 15, 19 and 21 depend from an allowable base claim and are therefore also in allowable form. Moreover, the addition of Meier does not correct the deficiencies in Kutscher. For this reason alone the rejection of claims 15, 19, and 21 should be reversed.

Moreover, the proposed combination is not proper as the references teach away from each other. Kutscher states that a purposed and intent of the device and method is to use already existing sensory mechanism such that sensors on the compressor are not required. (Please see Kutscher Column 4, lines 58-63). Meier discloses the use of back pressure sensors and temperature sensors for determining a temperature of the compressor. (Please see Meier, Column 7, lines 10-30). In other words, Meier requires additional sensors for operation, where Kutscher discloses a system that does not require additional sensors.

Accordingly, the use of the sensors disclosed in Meier as proposed by the Examiner is counter to and teaches away from a stated purpose of the base reference, Kutscher. There can be no supportable reason for making a proposed combination if that combination would destroy an intended operation of the base reference. That is the case with this propose combination, and for this further reason this rejection should be reversed.

(3) Claims 22and 23 are not obvious over Kutscher in view of Meier and further in view of Jayanth.

Claims 22 and 23 depend from an allowable base claim and are therefore also in allowable form. Moreover, the addition of Meier and Jayanth does not correct the deficiencies in Kutscher. For this reason alone the rejection of claims 22 and 23 should be reversed.

Moreover, for the reasons discussed above, the combination with Meier is not proper. The further addition of Jayanth is also not proper as Jayanth also teaches away from the proposed combination with Kutscher. In fact, as the Examiner argues, the Jayanth discloses the use of additional sensors to provide feedback used to control the compressor. Kutscher, in contrast has as a stated purpose to utilize only existing sensors to provide the data required to control the compressor. The addition of the multiple sensors discloses in the Jaynath reference is counter to

this purpose and would effectively change the intended and stated operation of the disclosed Kutscher device. Accordingly, for this additional reason, this rejection should be withdrawn.

CONCLUSION

For the reasons set forth above, the rejection of claims 13, 15 and 17-24 is improper and should be reversed. Appellant earnestly requests such an action.

Respectfully Submitted,

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CLAIMS APPENDIX

13. A method for controlling the operation of a compressor, in which the compressor is switched off by a control unit to avoid thermal damage if a compressor_temperature value (Ts(Tc)) calculated by said unit exceeds an upper threshold value (T_{max}), or remains switched on or is switched on if there is a compression requirement and if a lower threshold value (T_{min}) is not reached, comprising the steps of:

storing a mathematical-physical model in memory of the control unit wherein the mathematical-physical model characterizes cooling and heating properties of the compressor; and

calculating a temperature value (Ts(Tc)) of the compressor indirectly and cyclically by means of the mathematical-physical model by

determining physical-technical influencing variables (U), which influence the estimated temperature (Ts(Tc)) in a changing manner,

determining, with the aid of the influencing variables (U),at least one relative temperature (Tc_1; Tc_2), which describes the thermal state of the compressor,

adding or subtracting, for this purpose, the currently applicable influencing variables (U) from the cyclically prior value of the relative temperature (Tc_1, Tc_2), so that a currently applicable relative temperature (Tc_1; Tc_2) is obtained as the result of this calculation,

determining a currently applicable estimated temperature (Ts(Tc)), taking into account the heating and cooling behavior of the compressor, from this currently applicable relative temperature (Tc_1; Tc_2) and the ambient temperature ($T\infty$) of the compressor, and then

using this cyclically calculated temperature (Ts(Tc)) for carrying out a limit value comparison with a lower temperature threshold value (T_{min}) and an upper temperature threshold value (T_{max}), on the basis of which the operation of the compressor is controlled,

wherein the influencing variables (U) are entered in a heating function (B(U)), which describes the heating behavior of a specific compressor.

15. The method as claimed in claim 13,

wherein, apart from other variables, the influencing variables (U) include at least one of the following quantities:

the electric voltage (U_{comp}) at the compressor, the counterpressure (P) of the compression medium downstream of the compressor and, in the case of closed pressure systems, the admission pressure of the pressure medium at the inlet of the compressor.

17. The method as claimed in claim 13,

wherein the influencing variable (A(Tc)) represents a cooling function which takes into account the cooling properties of a specific compressor and the surroundings in which it is installed.

18. The method as claimed in claim 17,

wherein, to calculate a current value of the relative temperatures ($Tc_{1,i}$; $Tc_{2,i}$), the value of the cooling function (A(Tc)) is subtracted from the last predetermined or calculated values of the relative temperatures ($Tc_{1,i-1}$; $Tc_{2,i-1}$) if the compressor is not in operation or is in operation in the time interval considered, and the value of a heating function B(U) is added if the compressor is in operation in the time interval considered.

19. The method as claimed in claim 13,

wherein the relative temperature (Tc_1; Tc_2) and the calculated temperature (Ts(Tc)) for a time increment (i) are calculated according to the following equations:

with the compressor switched off

$$Tc_i = Tc_{i-1} - A\ Tc_{i-1}$$

and with the compressor switched on

$$Tc_i = Tc_{i-1} - A\ Tc_{i-1} + B\ U_i$$

and for the estimated temperature

$$Ts_i = C\ Tc_i + T\infty$$

in which the values A to C represent matrices with constant coefficients which characterize the compressor and the compressor surroundings, in particular with regard to their thermal properties.

20. The method as claimed in claim 13,

wherein the initial value of the relative temperature (Tc) is chosen such that the calculated temperature (Ts(Tc)) of the compressor corresponds to the value of the ambient temperature ($T\infty$) at the installation location of the compressor.

21. The method as claimed in claim 20,

wherein the initial value of the relative temperature (Tc) is set to the value zero at the beginning of the compressor control method.

22. The method as claimed in claim 13, comprising the following steps:

a) establishing the operating state of the compressor (on or off),
b) measuring at least one on the two following pressure values: the counterpressure P of the pressure medium downstream of the compressor and, in the case of closed systems, the admission pressure upstream of the compressor,
c) measuring the currently applicable operating voltage U_{comp} of the compressor,
d) measuring or estimating the ambient temperature $T\infty$ of the compressor,
e) determining the validity of the influencing variables, operating voltage U_{comp} and counterpressure P or the compressor inlet pressure (admission pressure),
f) calculating the current value of the heating function B(U) by using heating-specific influencing variables U,
g) calculating the current value of the cooling function A(Tc) by using the characteristic temperatures of the last time clock,

h) calculating the characteristic relative temperatures Tc_1; Tc_2 by addition and/or subtraction of the current values of the heating function B(U) and the cooling function A(Tc),

i) calculating the calculated temperature Ts(Tc) as a function of the characteristic relative temperatures Tc_1; Tc_2 and the ambient temperature $T\infty$,

j) comparison of the calculated temperature Ts(Tc) with predetermined temperature threshold values T_{min} and T_{max}, where T_{min} is less than T_{max},

k) clearance for starting the compressor if the calculated temperature Ts(Tc) is less than or equal to T_{min}, or authorization to continue operation if the estimated temperature Ts(Tc) is less than the temperature value T_{max},

l) switching off the compressor if the calculated temperature Ts(Tc) is greater than or equal to the temperature value T_{max},

m) storing the characteristic relative temperatures Tc_1; Tc_2 for use in the next calculation run,

n) waiting until the next time clock, and

o) starting the next calculation run (step a).

23. The method as claimed in claim 22,

wherein the validity of the measured variables, operating voltage U_{comp} and counterpressure P or admission pressure, is determined by these values being multiplied by the value "one" if the compressor is in operation or multiplied by the value "zero" if the compressor is not in operation.

24. The method as claimed in claim 13,

wherein, even if the calculated temperature (Ts(Tc)) is greater than the temperature threshold value (T_{min}), the compressor may be switched on if the operating time of the compressor, until the upper threshold value (T_{max}) is reached, is sufficient to convey an amount of pressure medium adequate for a specific application.

Evidence Appendix

None

Related Proceedings Appendix

None